Claims 1-3, 5, 9 and 12 stand rejected under § 103 on the basis of Chen et al., Okumura et al. and Ishikawa et al. Applicants respectfully traverse this rejection for the following reasons.

Amended claim 1 combines various elements in a magnetic recording disk to achieve the following results:

1) The glass or silicon substrate increases the shock resistance and thus the durability of the disk.

2) The first Cr-based underlayer improves sputtering of a second NiP underlayer to the substrate.

3) The sputtered NiP underlayer enables exact reproduction of the topographic features of the underlying substrate.

4) Mechanical texturing of the NiP underlayer improves the anisotropy of the magnetic layer, along with prevention of head stiction.

5) The controlled P content of 15 to 35 at % is especially suitable for texturing of the NiP underlayer.

6) The controlled surface roughness of less than 2 nm is especially suitable for floating a magnetic head over the disk.

7) The third Cr-based underlayer of at most 60 nm ensures the increased texturing effects of the NiP underlayer.

8) The widened lattice spacing of the third underlayer accelerates a preferential longitudinal orientation for the C-axis of the magnetic layer.

9) The Cr content of at least 14 at % and the Pt content of at least 4 at % enable a magnetic layer having a high S/N ratio to be obtained.

In summary, according to the present invention, prevention of peeling of the NiP underlayer, good anisotropy, low noise, high S/N ratio and good floatability of the head can be simultaneously obtained in a magnetic disk using glass or silicon as a substrate.

Referring now to USP '890, the examiner mentioned that USP '890 fails to disclose non-oriented irregularities on the glass substrate. However, the examiner asserts that such non-oriented irregularities are inherently present on the Ohara glass substrate due to cleaning and pre-treatments.

However, as is shown in the enclosed information sheet of the Ohara TS-10 glass referred to in the '890 reference, the glass substrate has a super smooth polished surface, and its surface roughness (Ra) is less than 0.5 nm. That is, the TS-10 glass substrate has no non-oriented irregularities on a surface thereof.

Further, according to the present invention, the substrate irregularities cannot be obtained by cleaning. As is disclosed on page 14, lines 30 to 35 of the specification, the irregularities can be produced by etching with a hydrofluoric acid, for example.

With regard to a textured surface on the NiP layer, the examiner mentioned that USP '890 fails to teach such a textured surface, but the examiner asserts that USP '733 discloses nearly an identical medium wherein a NiP alloy second underlayer has a textured surface. However, it should be noted that USP '733 is directed to solving the problem in the prior art medium (textured NiP layer- A1 alloy structure) and thus it teaches use of NiPX in place of NiP. Since the prior art medium uses an A1 alloy substrate, it is distinguished from

the glass or silicon substrate of the present invention. In addition, NiP and NiPX are clearly distinguished from each other with regard to their constitution and resulting functions.

Referring to USP '021, the examiner mentioned that USP '890 and '733 are silent concerning the surface roughness in the textured Ni surface, but USP '021 teaches the surface roughness. However, as described above, according to the present invention, the features (1) to (9), particularly the combination of the sputtering, thickness and P content of the NiP layer, obtain the remarkable effects of the present invention, whereas USP '021 is silent concerning this fact. For these reasons, applicants request reconsideration and withdrawal of this rejection.

In item 5 of the office action, the examiner rejected claims 6 to 8 under 35 U.S.C. § 103(a) as being unpatentable over USP '890 in view of USP '733 and '021 and further in view of Okuyama et al. (JP-A-09-293227, USP 6,071,607).

This rejection should be withdrawn because the present invention is distinguished from all of USP '890, '733 and '021 as discussed above, and it is also distinguishable from USP '607. That is, USP '607 only teaches the use of a four- or five-component metal alloy in the formation of a magnetic layer, and is silent concerning the relation between a first Cr-based layer and a second sputtered NiP layer, because they are not directed to use of a hard glass substrate. It should be also noted that USP '607 is directed to simultaneously obtaining low noise and high coercivity while enabling the use of a CrMo

underlayer capable of providing excellent functions, and thus it is silent concerning use of the NiP layer.

For the foregoing reasons, applicants believe that this case is in condition for allowance, which is respectfully requested. The examiner should call applicants' attorney if an interview would expedite prosecution.

Respectfully submitted,

GREER, BURNS & CRAIN, LTD.

By

Patrick G. Burns
Registration No. 29,367

May 24, 2002

300 South Wacker Drive
Suite 2500
Chicago, Illinois 60606
Telephone: 312.360.0080
Facsimile: 312.360.9315
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claim 1 was amended as follows:

1. (Amended three times) A magnetic recording disk comprising a nonmagnetic glass or silicon substrate having non-oriented irregularities on a surface thereof, and, having applied thereon in the following order:

an underlayer which comprises a first underlayer containing chromium as a principal component thereof, a second sputtered underlayer consisting of nickel and phosphorus and a third underlayer containing chromium as a principal component thereof which are formed in the described order,

wherein said second underlayer has a thickness of not less than 5nm, contains P in the concentration of 15 to 33 atom % in the NiP layer and has a mechanically textured structure having a surface roughness Ra_2 in a radial direction of less than 2 nm, and ~~formed by mechanical treatment, wherein~~said third underlayer has a thickness of not more than 60 nm and has a widened lattice spacing approaching the lattice spacing of a magnetic recording layer formed thereon, and

a magnetic recording layer which has a circumferential direction of easy magnetization and contains cobalt as a principal component thereof, and also contains

chromium in an amount of at least 14 at % and platinum in an amount of at least 4 at % in combination with tantalum or tantalum and niobium.

OHARA
Ohara Inc.

Glass-ceramics Substrate for HDD
TS-10

Ohara's Glass-ceramics offer Super High Density Data Recording

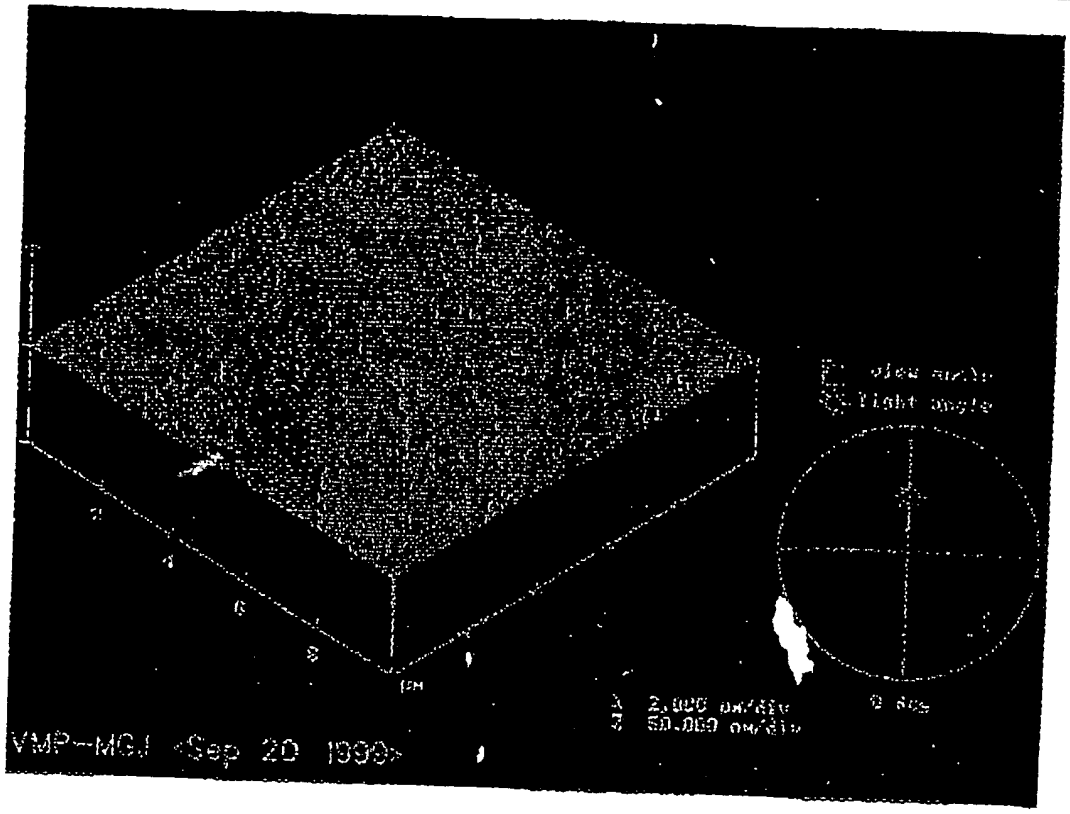
TS-10 is a Glass-ceramics material for use as an alternate substrate material for Hard Disks with excellent properties such as :

- Close thermal expansion coefficient as Magnetic Film Material
- High surface hardness
- High mechanical strength
- High thermal durability
- Super smooth polished surface
- These properties contribute to higher areal density, smaller and thinner disk design.

Properties

Characteristic	Unit	TS-10SX
Specific Gravity		2.47
Modulus of Elasticity	GPa	96

Specific Moculus	GPa	39
Vickers Hardness		740
CTE	10^{-7}/K -50~+70°C	74
Surface Roughness	AFM Ra nm	<0.5



TS-10SX AFM Image
Ra : 0.18nm

Available Size

1~2.5 inch

Click for the page of Ohara Products